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OSTROLENK FABER GERB & SOFFEN
1180 AVENUE OF THE AMERICAS
NEW YORK, NY 100368403

EXAMINER

IVEY, ELIZABETH D

ART UNIT	PAPER NUMBER
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1775

DATE MAILED: 12/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/779,309

Applicant(s)

MATSUMOTO ET AL.

Examiner

Elizabeth Ivey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 September 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,5-8,12-14 and 19-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,5-8,12-14 and 19-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 1-14 in the reply filed on September 28, 2006 is acknowledged.

Claim Rejections - 35 USC § 102

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 19 is rejected under 35 U.S.C. 102(a) and (e) as being anticipated by U.S. Patent Publication 20020172838 A1 to Rigney et al.

Regarding claim 19, Rigney discloses a thermal barrier coating system comprising a substrate of nickel and cobalt-based superalloys (metal substrate), an alloy or aluminide (metal) bonding layer, a (ceramic) thermal barrier layer with a YSZ or yttria stabilized zirconia composition in a columnar grain structure and containing 5.8-22.5 wt% or approximately 2-10 mol% lanthana (page 1 paragraph [0002], page 2 paragraphs [0009] and [0016] and page 4 claim 2). Rigney uses EBPVD to deposit the barrier coating but claim 19 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the

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product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process.” *See MPEP 2113*. As such, the process limitation within claim 19 does not provide patentable distinction over the prior art.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 5-7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication 20020172838 A1 to Rigney et al.

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Regarding claim 1, Rigney discloses a thermal barrier coating system comprising a substrate of nickel and cobalt-based superalloys, an alloy or aluminide bonding layer, a (ceramic) thermal barrier layer with a YSZ or yttria stabilized zirconia composition in a columnar grain structure and containing 5.8-22.5 wt% or approximately 2-10 mol% lanthana (page 1 paragraph [0002], page 2 paragraphs [0009] and [0016] and page 4 claim 2). Rigney uses EBPVD to deposit the barrier coating but claim 1 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claim 1 does not provide patentable distinction over the prior art. Although Rigney discloses 3 wt% yttria as preferable, he also discloses that conventionally 6-8 wt% is used for thermal barrier coatings, therefore it would have been obvious to a person having ordinary skill in the art to use the conventional higher wt% of yttria such as 6-8 wt% (about 3.5 – 5.25 mol%) to produce a thermal barrier coating with reduced thermal conductivity.

Regarding claim 5, Rigney discloses the bond coat to be a platinum aluminide or MCrAlX where M is iron cobalt and/or nickel and X is yttrium (page 1 paragraph [0002] and page 2 paragraph [0016]).

Regarding claims 6 and 7, Rigney discloses the component (substrate) to be a superalloy combustor or augmentor components for a gas turbine engine (page 1 paragraphs [0002] and [0008]).

Regarding claim 20, Rigney a thermal barrier coating system comprising a substrate of nickel and cobalt-based superalloys (metal substrate), an alloy or aluminide (metal) bonding layer, a (ceramic) thermal barrier layer with a YSZ or yttria stabilized zirconia composition in a columnar grain structure and containing 5.8-22.5 wt% or approximately 2-10 mol% lanthana (page 1 paragraph [0002], page 2 paragraphs [0009] and [0016] and page 4 claim 2). Rigney uses EBPVD to deposit the barrier coating but claim 20 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claim 20 does not provide patentable distinction over the prior art. Rigney discloses vertical columnar grains and porosity but does not expressly disclose then explicitly in the $\langle 100 \rangle$ or $\langle 001 \rangle$, or laminar or bar-shaped subgrains in plane on the surface of the columnar grains or the pore size or volume. However, a chemical composition and its properties are inseparable. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 *MPEP 2112.01*. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses

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the same production method, the claimed physical property relating to their <011> or <110> grain orientation and to the occurrence of the subgrains is inherently present in the prior art.

Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Also, Rigney does disclose that thermal conductivity of a columnar yttria stabilized zirconia thermal barrier coating is known to increase with pore coarsening or redistribution (volume %).

Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the pore size and volume for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 8, 12-14 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication 20020172838 A1 to Rigney et al. in view of U.S. Patent 4,939,107 to Ketcham.

Regarding claims 8 and 21, Rigney discloses a thermal barrier coating system comprising a substrate of nickel and cobalt-based superalloys, an alloy or aluminide bonding layer, a (ceramic) thermal barrier layer with a YSZ or yttria stabilized zirconia composition in a columnar grain structure and containing 5.8-22.5 wt% or approximately 2-10 mol% lanthana (page 1 paragraph [0002], page 2 paragraphs [0009] and [0016] and page 4 claim 2).

Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference

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because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Although Rigney discloses 3 wt% yttria as preferable, he also discloses that conventionally 6-8 wt% is used for thermal barrier coatings, therefore it would have been obvious to a person having ordinary skill in the art to use the conventional higher wt% of yttria such as 6-8 wt% (about 3.5 – 5.25 mol%) to produce a thermal barrier coating with reduced thermal conductivity. Rigney does not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic coating thereby producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because Rigney discloses superior impact and erosion resistance as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia solid solution in place of the zirconia component and in addition to the yttria and lanthana components to create a toughened thermal barrier coating with low thermal conductivity. Rigney uses EBPVD to deposit the barrier coating but claims 8 and 21 are product by process claims wherein the patentability of the product does not depend on its method of production. “If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process.” *See MPEP 2113*. As such, the process limitation within claims 8 and 21 does not provide patentable distinction over the prior art.

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Regarding claim 12, Rigney and Ketcham disclose all of the limitations of claim 8 and Rigney discloses the bond coat to be a platinum aluminide or MCrAlX where M is iron cobalt and/or nickel and X is yttrium (page 1 paragraph [0002] and page 2 paragraph [0016]).

Regarding claims 13 and 14, Rigney and Ketcham disclose all of the limitations of claim 8 and Rigney discloses the component (substrate) to be a superalloy combustor or augmentor components for a gas turbine engine (page 1 paragraphs [0002] and [0008]).

Regarding claim 22, Rigney discloses a thermal barrier coating system comprising a substrate of nickel and cobalt-based superalloys, an alloy or aluminide bonding layer, a (ceramic) thermal barrier layer with a YSZ or yttria stabilized zirconia composition in a columnar grain structure and containing 5.8-22.5 wt% or approximately 2-10 mol% lanthana (page 1 paragraph [0002], page 2 paragraphs [0009] and [0016] and page 4 claim 2). Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Rigney does not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic coating thereby producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because Rigney discloses superior impact and erosion resistance as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia

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solid solution in place of the zirconia component and in addition to the yttria and lanthana components to create a toughened thermal barrier coating with low thermal conductivity. Rigney uses EBPVD to deposit the barrier coating but claim 22 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claim 22 does not provide patentable distinction over the prior art. Also, Rigney discloses vertical columnar grains and porosity but does not expressly disclose the grains explicitly in the $\langle 100 \rangle$ or $\langle 001 \rangle$, or laminar or bar-shaped subgrains on the surface of the columnar grains or the pore size or volume. However, a chemical composition and its properties are inseparable. In *re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 *MPEP 2112.01*. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses the same production method, the claimed physical property relating to the $\langle 001 \rangle$ or $\langle 100 \rangle$ orientation of the grains and the occurrence of the subgrains is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Also, Rigney does disclose that thermal conductivity of a columnar yttria stabilized zirconia thermal barrier coating is known to increase with pore coarsening or redistribution (volume %). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the pore size and volume for the intended application, since it has been

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held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 1, 5-7 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication 20030059633 A1 to Ackerman et al. in view of U.S. Patent Application Publication 20020172838 A1 to Rigney et al.

Regarding claims 1, 5, and 19, Ackerman discloses a superalloy component protected by a thermal barrier coating system. The coating system comprises a (metal) bond coat of diffusion aluminide or MCrAlX where M is nickel, cobalt or iron and X is an element such as yttrium. The coating system also comprises a thermal barrier coating material arranged as a plurality of columnar grains of 3-12 wt% (about 1.7-8.6 mol%) yttria stabilized zirconia and an additional third oxide such as lanthana, acting as a sintering inhibitor to lower thermal conductivity (page 1 paragraphs [0004]-[0006] and [0009], page 2 paragraphs [0012]-[0014] and [0020] and page 3 paragraph [0025]). Although Ackerman does not disclose the percentage of lanthana used, Rigney discloses the use of 5.8-22.5 wt% or approximately 2-10 mol% lanthana in a columnar yttria stabilized zirconia thermal barrier layer to lower thermal conductivity (page 2 paragraph [0008] and page 4 claim 2). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the percentage of lanthana as used in Rigney in the invention of Ackerman to produce a lower thermal conductivity. Furthermore, it would have

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been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Rigney and Ackerman use EBPVD to deposit the barrier coating but claim 1 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claim 1 does not provide patentable distinction over the prior art.

Regarding claims 6-7, Ackerman and Rigney disclose all of the limitations of claim 1 and Ackerman discloses the superalloy article is a gas turbine engine component such as an airfoil (blade), or vane or combustor component.

Regarding claim 20, Ackerman discloses a superalloy component protected by a thermal barrier coating system. The coating system comprises a (metal) bond coat of diffusion aluminide or MCrAlX where M is nickel, cobalt or iron and X is an element such as yttrium. The coating system also comprises a thermal barrier coating material arranged as a plurality of columnar grains of 3-12 wt% (about 1.7-8.6 mol%) yttria stabilized zirconia and an additional third oxide such as lanthana, acting as a sintering inhibitor to lower thermal conductivity (page 1 paragraphs

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[0004]-[0006] and [0009], page 2 paragraphs [0012]-[0014] and [0020] and page 3 paragraph [0025]). Although Ackerman does not disclose the percentage of lanthana used, Rigney discloses the use of 5.8-22.5 wt% or approximately 2-10 mol% lanthana in a columnar yttria stabilized zirconia thermal barrier layer to lower thermal conductivity (page 2 paragraph [0008] and page 4 claim 2). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the percentage of lanthana as used in Rigney in the invention of Ackerman to produce a lower thermal conductivity. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Rigney and Ackerman use EBPVD to deposit the barrier coating but claim 20 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." See *MPEP 2113*. As such, the process limitation within claim 20 does not provide patentable distinction over the prior art. Ackerman and Rigney disclose vertical columnar grains and porosity but they do not expressly disclose laminar or bar-shaped subgrains on the surface of the columnar grains or the pore size or volume. However, a chemical composition and its properties are inseparable. In *re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 *MPEP 2112.01*. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses

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the same production method, the claimed physical property relating to the occurrence of the subgrains is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Also, Rigney does disclose that thermal conductivity of a columnar yttria stabilized zirconia thermal barrier coating is known to increase with pore coarsening or redistribution (volume %). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the pore size and volume for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 8, 12-14 and 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication 20030059633 A1 to Ackerman et al. in view of U.S. Patent Application Publication 20020172838 A1 to Rigney et al. further in view of U.S. Patent 4,939,107 to Ketcham.

Regarding claims 8, 12, 19 and 21, Ackerman discloses a superalloy component protected by a thermal barrier coating system. The coating system comprises a (metal) bond coat of diffusion aluminide or MCrAlX where M is nickel, cobalt or iron and X is an element such as yttrium. The coating system also comprises a thermal barrier coating material arranged as a plurality of columnar grains of 3-12 wt% (about 1.7-8.6 mol%) yttria stabilized zirconia and an additional third oxide such as lanthana, acting as a sintering inhibitor to lower thermal

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conductivity (page 1 paragraphs [0004]-[0006] and [0009], page 2 paragraphs [0012]-[0014] and [0020], page 3 paragraph [0025]). Although Ackerman does not disclose the percentage of lanthana used, Rigney discloses the use of 5.8-22.5 wt% or approximately 2-10 mol% lanthana in a columnar yttria stabilized zirconia thermal barrier layer to lower thermal conductivity (page 2 paragraph [0008] and page 4 claim 2). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the percentage of lanthana as used in Rigney in the invention of Ackerman to produce a lower thermal conductivity.

Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Rigney and Ackerman do not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic coating thereby producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because Rigney discloses superior impact and erosion resistance as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia solid solution in place of part of the zirconia component and in addition to, not in place of, the yttria and lanthana components to create a toughened thermal barrier coating with a lower thermal conductivity. Rigney and Ackerman use EBPVD to deposit the barrier coating but claim 8 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the

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product produced by the process is in some manner measurably distinct from the product produced by another process.” *See MPEP 2113*. As such, the process limitation within claim 8 does not provide patentable distinction over the prior art.

Regarding claims 13-14, Ackerman, Rigney and Ketcham disclose all of the limitations of claim 8 and Ackerman and Rigney both disclose the superalloy article is a gas turbine engine component such as an airfoil (blade), or vane or combustor component.

Regarding claims 20 and 22, Ackerman discloses a superalloy component protected by a thermal barrier coating system. The coating system comprises a (metal) bond coat of diffusion aluminide or MCrAlX where M is nickel, cobalt or iron and X is an element such as yttrium. The coating system also comprises a thermal barrier coating material arranged as a plurality of columnar grains of 3-12 wt% (about 1.7-8.6 mol%) yttria stabilized zirconia and an additional third oxide such as lanthana, acting as a sintering inhibitor to lower thermal conductivity (page 1 paragraphs [0004]-[0006] and [0009], page 2 paragraphs [0012]-[0014] and [0020], page 3 paragraph [0025]). Although Ackerman does not disclose the percentage of lanthana used, Rigney discloses the use of 5.8-22.5 wt% or approximately 2-10 mol% lanthana in a columnar yttria stabilized zirconia thermal barrier layer to lower thermal conductivity (page 2 paragraph [0008] and page 4 claim 2). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the percentage of lanthana as used in Rigney in the invention of Ackerman to produce a lower thermal conductivity. Furthermore, it would have

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been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Rigney and Ackerman do not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic coating thereby producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because Rigney discloses superior impact and erosion resistance as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia solid solution in place of part of the zirconia component and in addition to, not in place of, the yttria and lanthana components to create a toughened thermal barrier coating with a lower thermal conductivity. Rigney and Ackerman use EBPVD to deposit the barrier coating but claims 20 and 22 are product by process claims wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claims 20 and 22 does not provide patentable distinction over the prior art. Additionally, Ackerman discloses vertical columnar grains and Rigney discloses porosity but they do not expressly disclose the <001> or <100> grain orientation or the laminar or bar-shaped subgrains on the surface of the columnar grains or the pore size or volume. However, a chemical composition and its properties are inseparable. *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658

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MPEP 2112.01. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses the same production method, the claimed physical property relating to the occurrence of the subgrains is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Also, Rigney does disclose that thermal conductivity of a columnar yttria stabilized thermal barrier coating is known to increase with pore coarsening or redistribution (volume %). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the pore size and volume for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In *re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 1, 5-7 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,790,486 B2 to Movchan et al.

Regarding claims 1 and 19, Movchan discloses a superalloy (metal) substrate with a thermal barrier coating system (TBC) comprising a metallic bond coat and an upper 3-8 wt% (about 1.8-5.2 mol%) yttria stabilized zirconia (ceramic) thermal barrier layer with a third metal oxide such as ceria or lanthana among others included in the thermal barrier layer (column 4 lines 15-40 and column 5 lines 1-4 and 25-30). Movchan discloses the TBC has a columnar grain structure (column lines 66-67). Although Movchan does not show an express example

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using lanthana as the third metal oxide, Movchan does show an example of a third metal oxide addition of about 10-20wt% of ceria, which is presented by Movchan as a functional equivalent of lanthana (about 4-9 mol%) (column 5 lines 35-40). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a 10-20 wt% addition of lanthana in place of the ceria in the stabilized zirconia thermal barrier layer. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Movchan uses EBPVD to deposit the barrier coating but claims 1 and 19 are product by process claims wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claims 1 and 19 does not provide patentable distinction over the prior art.

Regarding claim 5, Movchan discloses the metallic bond coat is a MCrAlX or a diffusion aluminide or a diffusion platinum aluminide (column 4 lines 25-32).

Regarding claims 6-7, Movchan discloses the substrate is a turbine nozzle, blade shroud or combustor liner (column 4 lines 15-20).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6790486 B2 to Movchan et al. in view of U.S. Patent Publication 20020172838 A1 to Rigney et al.

Regarding claim 20, Movchan discloses a superalloy (metal) substrate with a thermal barrier coating system (TBC) comprising a metallic bond coat and an upper 3-8 wt% (about 1.8-5.2 mol%) yttria stabilized zirconia (ceramic) thermal barrier layer with a third metal oxide such as ceria or lanthana among others included in the thermal barrier layer (column 4 lines 15-40 and column 5 lines 1-4 and 25-30). Movchan discloses the TBC has a columnar grain structure (column lines 66-67). Although Movchan does not show an express example using lanthana as the third metal oxide, Movchan does show an example of a third metal oxide addition of about 10-20wt% of ceria, which is presented by Movchan as a functional equivalent of lanthana (about 4-9 mol%) (column 5 lines 35-40). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a 10-20 wt% addition of lanthana in place of the ceria in the stabilized zirconia thermal barrier layer. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Movchan uses EBPVD to deposit the barrier coating but claim 20 is a product by process claim wherein

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the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." See *MPEP 2113*. As such, the process limitation within claim 20 does not provide patentable distinction over the prior art. Movchan discloses vertical columnar grains and porosity but does not expressly disclose the <001> or <100> grain orientation or the laminar or bar-shaped subgrains on the surface of the columnar grains or pores and their associated size or volume. However, a chemical composition and its properties are inseparable. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 *MPEP 2112.01*. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses the same production method, the claimed physical property relating to the grain orientation and the occurrence of the subgrains is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Movchan does not discuss porosity, however Rigney discloses that thermal barrier coatings having the same constituents and made with the same process have pores. Additionally, Rigney does disclose that thermal conductivity of a columnar yttria stabilized zirconia thermal barrier coating is known to increase with pore coarsening or redistribution (volume %). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention combine the teachings of Rigney with those of Movchan to adjust the pore size and volume for the intended application, since it has been held that discovering an optimum value of a result effective

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variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claims 8, 12-14 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6790486 B2 to Movchan et al. in view of U.S. Patent 4,939,107 to Ketcham.

Regarding claims 8 and 21, Movchan discloses a superalloy (metal) substrate with a thermal barrier coating system (TBC) comprising a metallic bond coat and an upper 3-8 wt% (about 1.8-5.2 mol%) yttria stabilized zirconia (ceramic) thermal barrier layer with a third metal oxide such as ceria or lanthana among others included in the thermal barrier layer (column 4 lines 15-40 and column 5 lines 1-4 and 25-30). Movchan discloses the TBC has a columnar grain structure (column lines 66-67). Although Movchan does not show an express example using lanthana as the third metal oxide, Movchan does show an example of a third metal oxide addition of about 10-20wt% of ceria, which is presented by Movchan as a functional equivalent of lanthana (about 4-9 mol%) (column 5 lines 35-40). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a 10-20 wt% addition of lanthana in place of the ceria in the stabilized zirconia thermal barrier layer. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Movchan does not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic material thereby

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producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because Movchan discloses durability of components as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia solid solution in place of the zirconia component and in addition to the yttria and lanthana components to create a toughened thermal barrier coating with low thermal conductivity. Movchan uses EBPVD to deposit the barrier coating but claims 8 and 21 are product by process claims wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claims 8 and 21 does not provide patentable distinction over the prior art.

Regarding claim 12, Movchan and Ketcham disclose all of the limitations of claim 8 and Movchan discloses the metallic bond coat is a MCrAlX or a diffusion aluminide or a diffusion platinum aluminide (column 4 lines 25-32).

Regarding claims 13-14, Movchan and Ketcham disclose all of the limitations of claim 8 and Movchan discloses the substrate is a turbine nozzle, blade shroud or combustor liner (column 4 lines 15-20).

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6790486 B2 to Movchan et al. in view of U.S. Patent 4,939,107 to Ketcham and further in view of U.S. Patent Publication 20020172838 A1 to Rigney et al.

Regarding claim 22, Movchan discloses a superalloy (metal) substrate with a thermal barrier coating system (TBC) comprising a metallic bond coat and an upper 3-8 wt% (about 1.8-5.2 mol%) yttria stabilized zirconia (ceramic) thermal barrier layer with a third metal oxide such as ceria or lanthana among others included in the thermal barrier layer (column 4 lines 15-40 and column 5 lines 1-4 and 25-30). Movchan discloses the TBC has a columnar grain structure (column lines 66-67). Although Movchan does not show an express example using lanthana as the third metal oxide, Movchan does show an example of a third metal oxide addition of about 10-20wt% of ceria, which is presented by Movchan as a functional equivalent of lanthana (about 4-9 mol%) (column 5 lines 35-40). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a 10-20 wt% addition of lanthana in place of the ceria in the stabilized zirconia thermal barrier layer. Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, *In re Malagari*, 182 USPQ 549. Movchan does not disclose a zirconia-hafnia solid solution but Ketcham discloses using hafnia in a solid solution with zirconia to produce a tougher ceramic material thereby producing better wear and abrasion resistance (column 1 lines 22-24 and 64-68 and column 2 lines 24-25). Because

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Movchan discloses durability of components as desirable, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use a zirconia-hafnia solid solution in place of the zirconia component and in addition to the yttria and lanthana components to create a toughened thermal barrier coating with low thermal conductivity. Movchan uses EBPVD to deposit the barrier coating but claim 22 is a product by process claim wherein the patentability of the product does not depend on its method of production. "If the product in the product by process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process unless it can be shown that the product produced by the process is in some manner measurably distinct from the product produced by another process." *See MPEP 2113*. As such, the process limitation within claim 22 does not provide patentable distinction over the prior art. Movchan and Ketcham disclose vertical columnar grains and porosity but do not expressly disclose the grains in the $\langle 001 \rangle$ or $\langle 100 \rangle$ orientation or the laminar or bar-shaped subgrains on the surface of the columnar grains or pores and their associated size or volume. However, a chemical composition and its properties are inseparable. *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 *MPEP 2112.01*. Because the prior art exemplifies the applicant's claimed composition in relation to the columnar grains and discloses the same production method, the claimed physical property relating to the occurrence of the subgrains is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art. Movchan and Ketchum do not discuss porosity, however Rigney discloses that thermal barrier coatings having the same constituents and made with the same process have pores. Additionally, Rigney does

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disclose that thermal conductivity of a columnar yttria stabilized zirconia thermal barrier coating is known to increase with pore coarsening or redistribution (volume %). Therefore it would have been obvious to a person having ordinary skill in the art at the time of the invention combine the teachings of Rigney with those of Movchan and Ketcham to adjust the pore size and volume for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

Examiner acknowledges applicant's amendment to claims 1 and 8, cancellation of claims 2-4, 9-11, and 15-18 and addition of new claims 19-22.

Applicant's arguments filed September 28, 2006 have been fully considered but they are not persuasive.

Regarding applicant's argument that Rigney does not make obvious a yttria content greater than 3 wt%, examiner directs applicant's attention to the abstract wherein Rigney discloses 6-8 wt% YSZ as conventional and indicates only that it is preferable to have no more than 3%. Preferability of a weight percentage does not negate obviousness of a disclosed conventional weight percent. As such, all the disclosures in a reference must be evaluated for what they fairly teach one of ordinary skill in the art even though the art teachings relied upon are phrased in terms of a non-preferred embodiment or even as being unsatisfactory for the intended purpose, *In re Boe*, 148 USPQ 507 (CCPA 1966); *In re Smith*, 65 USPQ 167 (CCPA 1945); *In re Nehrenberg*, 126 USPQ 383 (CCPA 1960); *In re Watanabe*, 137 USPQ 350 (CCPA

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Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elizabeth Ivey whose telephone number is (571) 272-8432. The examiner can normally be reached on 7:00- 4:30 M-Th and 7:00-3:30 alt. Fridays.

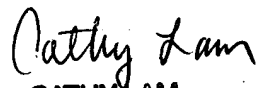
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Elizabeth D. Ivey


CATHY LAM
PRIMARY EXAMINER
Dec. 05, 2006